## Claims

1. An analytical chip for the simultaneous determination of one or more different bacterial 16S-rRNA in a liquid sample
   comprising
   - an evanescent field measurement platform, e.g. an optical waveguide, as a solid carrier and
   - a plurality of specific recognition elements immobilized in discrete measurement areas of known location forming an array of measurement areas on said evanescent field measurement platform,

   wherein
   - a multitude (i.e. 2 or more) of different specific recognition elements is immobilized in discrete measurement areas for the recognition and detection of each different 16S-rRNA, different recognition elements being specific for different subsequences of the 16S-rRNA to be detected, which are not directly adjacent and not overlapping in the sequence of said 16S-rRNA, and

   and said analytical chip is operable for the detection of 16S-rRNA in the evanescent field of the evanescent field measurement platform, without an amplification (e.g. by polymerase chain reaction PCR or linear amplification "T7") of the polynucleotide sequences contained in the sample.

2. An analytical chip according to claim 1, wherein said analytical chip is operable for a simultaneous quantitative determination of one or more different bacterial 16S-rRNA in a liquid sample, i.e. with an experimental variation of less than 50 %, preferably of less than 20 %, most preferably of less than 10 %.

3. An analytical chip according to any of claims 1 – 2, wherein said analytical chip is operable for a simultaneous quantitative determination of the amount respectively concentration of the one or more different bacteria in the original sample from where the liquid sample containing said one or more different 16S-rRNA have been derived.

4. An analytical chip according to any of claims 1 - 3, wherein the one or more bacterial 16S-rRNA to be detected are derived from bacteria selected from the group comprising, e.g.:

| Genus | Species |
|---|---|
| Achromobacter | xylosoxidans |
| Acinetobacter | baumannii |
| Acinetobacter | calcoaceticus |
| Acinetobacter | junii |
| Acinetobacter | wolfii |
| Actinobacillus | sp |
| Actinomyces | israelii |
| Actinomyces | meyeri |
| Actinomyces | odontolyticus |
| Actinomyces | sp |
| Aerococcus | viridans |
| Aeromonas | caviae |
| Aeromonas | hydrophilia |
| Aeromonas | sobria |
| Agrobacterium | radiobacter |
| Alcaligenes | denitrificans |
| Alcaligenes | faecalis |
| Alcaligenes | sp |
| Alcaligenes | xylosoxydans |
| Bacillus | sp |
| Bacteroides | bivius |
| Bacteroides | buccae |
| Bacteroides | caccae |
| Bacteroides | denticola |
| Bacteroides | disiens |
| Bacteroides | distasonis |
| Bacteroides | fragilis |
| Bacteroides | oralis |
| Bacteroides | oris |
| Bacteroides | ovatus |
| Bacteroides | stercoris |
| Bacteroides | thetaiotomicron |
| Bacteroides | uniformis |
| Bacteroides | ureolyticus |
| Bacteroides | vulgatus |
| Bifidobacterium | sp |
| Bordetella | bronchiseptica |
| Brucella | melitensis |
| Burkholderia | cepacia |
| Burkholderia | picketti |
| Burkholderia | pseudomallei |
| Campylobacter | coli |
| Campylobacter | fetus |
| Campylobacter | jejuni |
| Campylobacter | sp |
| Capnocytophaga | canimorsus |
| Capnocytophaga | ochracea |
| Capnocytophaga | sp |
| Chryseomonas | luteola |
| Citrobacter | amalonaticus |
| Citrobacter | braakii |
| Citrobacter | diversus |
| Citrobacter | freundii |
| Citrobacter | koseri |
| Citrobacter | sp |
| Clostridium | bifermentans |
| Clostridium | butyricum |
| Clostridium | clostridiiforme |
| Clostridium | paraputrificum |

| | |
|---|---|
| Clostridium | perfringens |
| Clostridium | ramosum |
| Clostridium | septicum |
| Clostridium | tertium |
| Clostridiumi | innocuum |
| Comamonas | acidovora |
| Corynebacterium | aquaticum |
| Corynebacterium | bovis |
| Corynebacterium | jeikeium |
| Corynebacterium | minutissimum |
| Corynebacterium | sp |
| Eikenella | corrodens |
| Empedobacter | brevis |
| Entereococcus | casseliflavus |
| Enterobacter | aerogenes |
| Enterobacter | agglomerans |
| Enterobacter | amnigenus |
| Enterobacter | cloacae |
| Enterococcus | avium |
| Enterococcus | durans |
| Enterococcus | faecalis |
| Enterococcus | faecium |
| Enterococcus | gallinarium |
| Enterococcus | raffinosus |
| Escherichia | coli |
| Eubacterium | aerofaciens |
| Eubacterium | lentum |
| Eubacterium | limosum |
| Flavobacterium | breve |
| Flavobacterium | meningosepticum |
| Flavobacterium | sp |
| Fusobacterium | sp |
| Fusobacterium | mortiferum |
| Fusobacterium | necrophorum |
| Fusobacterium | nucleatum |
| Fusobacterium | varium |
| Gardnerella | vaginalis |
| Gemella | haemolysans |
| Gemella | morbillorum |
| Gemella | sp |
| Haemophilus | aphrophilus |
| Haemophilus | influenzae |
| Haemophilus | parainfluenzae |
| Haemophilus | paraphrophilus |
| Hafnia | alvei |
| Kingella | sp |
| Klebsiella | ornithinolytica |
| Klebsiella | oxytoca |
| Klebsiella | ozaenae |
| Klebsiella | pneumoniae |
| Kluyvera | sp |
| Lactobacillus | acidophilus |
| Lactobacillus | catenaforme |
| Lactococcus | cremoris |
| Lactococcus | lactis |
| Legionella | pneumophila |
| Leptotrichia | buccalis |
| Leuconostoc | sp |
| Listeria | monocytogenes |
| Moraxella | catarrhalis |

| | |
|---|---|
| Moraxella | osloensis |
| Moraxella | phenylpyruvica |
| Moraxella | sp |
| Morganella | morganii |
| Mycobacterium | avium |
| Mycobacterium | genavense |
| Mycobacterium | tuberculosis |
| Mycobacterium | avium-intracellulare |
| Mycoplasma | sp |
| Myroides | odoratum |
| Neisseria | cinerea |
| Neisseria | flavescens |
| Neisseria | meningitidis |
| Neisseria | mucosa |
| Neisseria | sp |
| Neisseria | subflava |
| Nocardia | asteroides |
| Nocardia | sp |
| Ochrobactrum | anthropi |
| Pasteurella | multocida |
| Peptostreptococcus | anaerobius |
| Peptostreptococcus | asaccharolyticus |
| Peptostreptococcus | magnus |
| Peptostreptococcus | micros |
| Peptostreptococcus | prevotii |
| Prevotella | bivia |
| Prevotella | buccae |
| Prevotella | loescheii |
| Propionibacterium | acnes |
| Propionibacterium | granulosum |
| Proteus | mirabilis |
| Proteus | penneri |
| Proteus | vulgaris |
| Providencia | rettgeri |
| Providencia | sp |
| Providencia | stuartii |
| Pseudomonas | aeroginosa |
| Pseudomonas | alcaligenes |
| Pseudomonas | diminuta |
| Pseudomonas | fluorescens |
| Pseudomonas | paucimobilis |
| Pseudomonas | putida |
| Pseudomonas | sp |
| Pseudomonas | stutzeri |
| Pseudomonas | vesicularis |
| Salmonella | enteritidis |
| Salmonella | paratyphi |
| Salmonella | typhi |
| Salmonella | typhimurium |
| Serratia | fonticola |
| Serratia | marcescens |
| Serratia | odorifera |
| Serratia | sp |
| Shigella | dysenteria |
| Shigella | flexneri |
| Shigella | sonnei |
| Sphingomonas | paucimobilis |
| Staphylococcus | aureus |
| Staphylococcus | auricularis |
| Staphylococcus | capitis |

| | |
|---|---|
| Staphylococcus | caprae |
| Staphylococcus | chromogenes |
| Staphylococcus | cohnii |
| Staphylococcus | epidermidis |
| Staphylococcus | haemolyticus |
| Staphylococcus | hominis |
| Staphylococcus | intermedius |
| Staphylococcus | kloosii |
| Staphylococcus | lugdunensis |
| Staphylococcus | saccharolyticus |
| Staphylococcus | saprophyticus |
| Staphylococcus | sciuri |
| Staphylococcus | simulans |
| Staphylococcus | warneri |
| Staphylococcus | xylosus |
| Stenotrophomonas | maltophilia |
| Stomatococcus | mucilaginosus |
| Streptococcus | acidiminimus |
| Streptococcus | adjacens |
| Streptococcus | agalactiae |
| Streptococcus | anginosus |
| Streptococcus | bovis |
| Streptococcus | canis |
| Streptococcus | constellatus |
| Streptococcus | cremoris |
| Streptococcus | crista |
| Streptococcus | defectivus |
| Streptococcus | dysgalactiae |
| Streptococcus | equinus |
| Streptococcus | equisimilis |
| Streptococcus | intermedius |
| Streptococcus | lactis |
| Streptococcus | mitis |
| Streptococcus | mutans |
| Streptococcus | oralis |
| Streptococcus | pneumoniae |
| Streptococcus | pyogenes |
| Streptococcus | salivarius |
| Streptococcus | sanguis |
| Streptococcus | alpha-hemolyticus |
| Streptococcus | beta-hemolyticus |
| Veillonella | parvula |
| Veillonella | sp |
| Yersinia | enterocolitica |

5. An analytical chip according to any of claims 1 – 4, wherein the immobilized specific recognition elements are selected from the group comprising, e.g., natural and synthetically fabricated polynucleotides, polynucleotides with artificial bases and / or artificial carbohydrates, peptides, peptide nucleic acids ("PNA"s), PNA's with artificial bases, LNAs, proteins (e.g. antibodies), ribozymes, and aptamers.

6. An analytical chip according to any of claims 1 – 4, wherein the immobilized specific recognition elements are selected from the group of antibiotics-based recognition

elements comprising, e.g., macrolide antibiotics (e.g. erythromycin, azithromycin, streptogramin), aminoglycoside antibiotics (e.g. neomycin, paromomycin, lividomycin, gentamycin), and peptide antibiotics (e.g. thiostreptone, micrococcin).

7. An analytical chip according to any of claims 1 – 4, for the simultaneous determination of one or more different bacterial 16S-rRNA in a liquid sample, comprising
   - an evanescent field measurement platform, e.g. an optical waveguide, as a solid carrier and
   - a plurality of polynucleotides immobilized in discrete measurement areas of known location forming an array of measurement areas on said evanescent field measurement platform,

   wherein
   - a multitude (i.e. 2 or more) of different polynucleotides is immobilized in discrete measurement areas for the detection of each different 16S-rRNA, the sequences of the immobilized polynucleotides being essentially complementary to different subsequences of the 16S-rRNA to be detected, which are not directly adjacent and not overlapping in the sequence of said 16S-rRNA, and
   - and said analytical chip is operable for the detection of 16S-rRNA in the evanescent field of the evanescent field measurement platform, without an amplification (e.g. by polymerase chain reaction PCR or linear amplification "T7") of the polynucleotide sequences contained in the sample.

8. An analytical chip according to claim 7, wherein the immobilized polynucleotides for the detection of the bacterial 16S-rRNA have a length of 5 – 500, preferably of 10 – 100, most preferably of 10 - 30 bases.

9. An analytical chip according to any of claims 7 – 8, wherein the plurality of immobilized polynucleotides comprises 2 – 20 different polynucleotides which are essentially complementary to different subsequences of the same bacterial 16S-rRNA to be detected.

10. An analytical chip according to claim 9, wherein the plurality of immobilized polynucleotides comprises less than 10, preferably less than 5 different polynucleotides which are essentially complementary to different subsequences of the same bacterial 16S-rRNA to be detected.

11. An analytical chip according to any of claims 1 - 6, wherein the plurality of immobilized specific recognition elements comprises less than 10, preferably less than 5 different specific recognition elements which can bind specifically to different subsequences of the same bacterial 16S-rRNA to be detected.

12. An analytical chip according to any of claims 7 - 10, wherein the sequences of the multitude of immobilized polynucleotides for detection of a 16S-rRNA are essentially complementary to subsequences indicative for the genus of the bacterium from which said 16S-rRNA to be detected has been derived.

13. An analytical chip according to any of claims 7 - 10, wherein the sequences of the multitude of immobilized polynucleotides for detection of a 16S-rRNA are essentially complementary to subsequences indicative for the species and / or strain of the bacterium from which said 16S-rRNA to be detected has been derived.

14. An analytical chip according to any of claims 7 - 10, wherein the multitude of immobilized polynucleotides for detection of a 16S-rRNA comprises both polynucleotides with a sequence essentially complementary to subsequences indicative for the genus type and polynucleotides with a sequence essentially complementary to the species and / or strain of the bacterium from which said 16S-rRNA to be detected has been derived.

15. An analytical method according to any of claims 1 – 14, wherein the liquid sample comprises a complex biological matrix of the group of human and animal cell extracts, extracts of human and animal tissue, such as organ, skin or bone tissue, and of body fluids or their components, such as blood, serum, plasm, lymph, synovia, tear liquid, sweat, milk, sperm, sputum, cerebral spinal fluid, gastric juice, intestinal contents, urine, and stool.

16. An analytical chip according to any of claims 1 - 14, wherein the evanescent field measurement platform comprises an optical waveguide

17. An analytical chip according to any of claims 1 – 14, wherein the evanescent field measurement platform comprises an optical waveguide, which is continuous or partitioned into discrete waveguiding areas.

18. An analytical chip according to claim 17, wherein the optical waveguide is an optical film waveguide with a first optically transparent layer (a) on a second optically transparent layer (b) with lower refractive index than layer (a).

19. An analytical chip according to claim 18, wherein the material of the second optically transparent layer (b) comprises, e.g., silicates, such as glass or quartz, or a transparent thermoplastic or moldable plastic, preferably of the group comprising polycarbonate, polyimide, or polymethylmethacrylate, or polystyrene.

20. An analytical chip according to any of claims 18 - 19, wherein the refractive index of the first optically transparent layer (a) is higher than 1.8.

21. An analytical chip according to any of claims 18 - 20, wherein the first optically transparent layer (a) comprises $TiO_2$, ZnO, $Nb_2O_5$, $Ta_2O_5$, $HfO_2$, or $ZrO_2$, preferably $TiO_2$, $Ta_2O_5$ or $Nb_2O_5$.

22. An analytical chip according to any of claims 18 -21, wherein the thickness of the first optically transparent layer (a) is between 40 and 300 nm, preferably between 100 and 200 nm.

23. An analytical chip according to any of claims 18 - 22, wherein an additional optically transparent layer (b') with lower refractive index than and in contact with layer (a), and with a thickness of 5 nm – 10 000 nm, preferably of 10 nm – 1000 nm, is located between the optically transparent layers (a) and (b).

24. An analytical chip according to any of claims 18 - 23, wherein in-coupling of excitation light into the optically transparent layer (a), to the measurement areas, is

performed using one or more optical in-coupling elements from the group comprising prism couplers, evanescent couplers comprising joined optical waveguides with overlapping evanescent fields, front face (distal end) couplers with focusing lenses arranged in front of a front face (distal end) of the waveguiding layer, and grating couplers.

25. An analytical chip according to any of claims 18 - 23, wherein in-coupling of excitation light into the optically transparent layer (a), to the measurement areas, is performed using one or more grating structures (c), that are formed in the optically transparent layer (a).

26. An analytical chip according to any of claims 18 - 25, wherein out-coupling of light guided in the optically transparent layer (a) is performed using grating structures (c') that are formed in the optically transparent layer (a).

27. An analytical chip according to any of claims 25 - 26, wherein one or more measurement areas of an array of measurement areas are provided on a grating structure (c) or (c').

28. An analytical chip according to claim 27, wherein several or all arrays of measurement areas are provided on a common grating structure (c) or (c').

29. An analytical chip according to any of claims 25 – 26, wherein arrays of measurement areas are provided adjacent to or between grating structures (c) or (c').

30. An analytical chip according to any of claims 1 – 29, wherein an adhesion-promoting layer (f), with a thickness of preferably less than 200 nm, more preferably of less than 20 nm, is deposited on the optically transparent layer (a), for immobilization of the specific recognition elements, and wherein the adhesion-promoting layer preferably comprises chemical compounds of the group comprising, e.g., silanes, epoxides, functionalized, charged or polar polymers and "self-organized passive or functionalized mono- or multilayers", alkyl phosphates or alkyl phosphonates, and multifunctional block copolymers, such as poly(L)lysine / polyethylene glycols.

31. An analytical chip according to any of claims 1 – 30, wherein the specific recognition elements are immobilized in discrete measurement areas by one or more methods of the group of immobilization methods comprising, e.g., "ink jet spotting", mechanical spotting by means of pin, pen or capillary, "micro contact printing", fluidically contacting the measurement areas with the biological or biochemical or synthetic recognition elements upon their supply in parallel or crossed micro channels, upon exposure to pressure differences or to electric or electromagnetic potentials.

32. An analytical chip according to any of claims 30 – 31, wherein the adhesion-promoting layer is "chemically neutral" towards compounds other than the analytes contained in the sample, i.e., reduces nonspecific interaction with these compounds.

33. An analytical chip according to any of claims 1 – 32, wherein compounds which are "chemically neutral" towards the analytes and / or towards other compounds contained in the sample matrix, preferably of the groups comprising, for example, albumines, especially bovine serum albumine or human serum albumine, fragmentated natural or synthetic DNA, such as from herring or salmon sperm, not hybridizing with polynuleotides to be analyzed, or uncharged but hydrophilic polymers, such as polyethyleneglycols or dextranes, are deposited between the laterally separated measurement areas.

34. An analytical chip according to any of claims 1 – 33, wherein up to 1,000,000 measurement areas are provided in a 2-dimensional arrangement and wherein a single measurement area has an area of 0.001 $mm^2$ – 6 $mm^2$.

35. An analytical chip according to any of claims 1 – 34, wherein the measurement areas are provided at a density of more than 10, preferably of more than 100, most preferably of more than 1000 measurement areas per square centimeter.

36. An analytical chip according to any of claims 1 – 34, wherein the surface with the discrete measurement areas with immobilized specific recognition elements forms the inner bottom surface of one or more sample compartments for receiving one or more samples to be analyzed for 16S-rRNA.

37. An analytical chip according to claim 36, wherein the one or more sample compartments are designed to accommodate a sample volume of less than 50 $\mu$l.

38. An analytical chip according to any of claims 36 – 37, wherein the inner bottom surface of a sample compartment is larger than 10 $mm^2$.

39. An analytical chip according to any of claims 36 - 38, wherein grating structures (c) and optional additional grating structures (c') are located within a sample compartment.

40. An analytical chip according to any of claims 36 - 38, wherein grating structures (c) and optional additional grating structures (c') are located outside the sample compartments.

41. An analytical chip according to any of claims 36 - 40, wherein grating structures (c) and optional additional grating structures (c') extend over the range of multiple or all sample compartments.

42. An analytical method for the simultaneous determination of one or more different bacterial 16S-rRNA in a liquid sample, comprising providing an analytical chip comprising

- an evanescent field measurement platform, e.g. an optical waveguide, as a solid carrier and
- a plurality of specific recognition elements immobilized in discrete measurement areas of known location forming an array of measurement areas on said evanescent field measurement platform,

wherein

- a multitude (i.e. 2 or more) of different specific recognition elements is immobilized in discrete measurement areas for the recognition and detection of each different 16S-rRNA, different recognition elements being specific for different subsequences of the 16S-rRNA to be detected, which are not directly adjacent and not overlapping in the sequence of said 16S-rRNA,
- a liquid sample, not being subjected to an amplification (e.g. by polymerase chain reaction PCR or linear amplification "T7") of the polynucleotide

sequences contained therein, is brought into contact with the array under conditions allowing for binding (respectively hybridization) of 16S-rRNA contained in the sample with the corresponding specific recognition elements immobilized in the measurement areas

- changes of electro-optical signal caused by a successful binding on the measurement areas of the evanescent field measurement platform are measured with one or more detectors, and
- the presence of a bacterium to be detected is determined from the whole of signals from those measurement areas occupied by immobilized specific recognition elements dedicated for the specific detection of said bacterium.

43. An analytical method according to claim 42, wherein said analytical method is operable for a simultaneous quantitative determination of one or more different bacterial 16S-rRNA in a liquid sample, i.e. with an experimental variation of less than 50 %, preferably of less than 20 %, most preferably of less than 10 %.

44. An analytical method according to any of claims 42 – 43, wherein said analytical method is operable for a simultaneous quantitative determination of the amount respectively concentration of the one or more different bacteria in the original sample from where the liquid sample containing said one or more different 16S-rRNA have been derived.

45. An analytical method according to any of claims 42 - 44, wherein the one or more bacterial 16S-rRNA to be detected are derived from bacteria selected from the group comprising, e.g.:

| Genus | Species |
|---|---|
| Achromobacter | xylosoxidans |
| Acinetobacter | baumannii |
| Acinetobacter | calcoaceticus |
| Acinetobacter | junii |
| Acinetobacter | wolfii |
| Actinobacillus | sp |
| Actinomyces | israelii |
| Actinomyces | meyeri |
| Actinomyces | odontolyticus |
| Actinomyces | sp |
| Aerococcus | viridans |
| Aeromonas | caviae |
| Aeromonas | hydrophilia |
| Aeromonas | sobria |

| | |
|---|---|
| Agrobacterium | radiobacter |
| Alcaligenes | denitrificans |
| Alcaligenes | faecalis |
| Alcaligenes | sp |
| Alcaligenes | xylosoxydans |
| Bacillus | sp |
| Bacteroides | bivius |
| Bacteroides | buccae |
| Bacteroides | caccae |
| Bacteroides | denticola |
| Bacteroides | disiens |
| Bacteroides | distasonis |
| Bacteroides | fragilis |
| Bacteroides | oralis |
| Bacteroides | oris |
| Bacteroides | ovatus |
| Bacteroides | stercoris |
| Bacteroides | thetaiotomicron |
| Bacteroides | uniformis |
| Bacteroides | ureolyticus |
| Bacteroides | vulgatus |
| Bifidobacterium | sp |
| Bordetella | bronchiseptica |
| Brucella | melitensis |
| Burkholderia | cepacia |
| Burkholderia | picketti |
| Burkholderia | pseudomallei |
| Campylobacter | coli |
| Campylobacter | fetus |
| Campylobacter | jejuni |
| Campylobacter | sp |
| Capnocytophaga | canimorsus |
| Capnocytophaga | ochracea |
| Capnocytophaga | sp |
| Chryseomonas | luteola |
| Citrobacter | amalonaticus |
| Citrobacter | braakii |
| Citrobacter | diversus |
| Citrobacter | freundii |
| Citrobacter | koseri |
| Citrobacter | sp |
| Clostridium | bifermentans |
| Clostridium | butyricum |
| Clostridium | clostridiiforme |
| Clostridium | paraputrificum |
| Clostridium | perfringens |
| Clostridium | ramosum |
| Clostridium | septicum |
| Clostridium | tertium |
| Clostridiumi | innocuum |
| Comamonas | acidovora |
| Corynebacterium | aquaticum |
| Corynebacterium | bovis |
| Corynebacterium | jeikeium |
| Corynebacterium | minutissimum |
| Corynebacterium | sp |
| Eikenella | corrodens |
| Empedobacter | brevis |
| Entereococcus | casseliflavus |
| Enterobacter | aerogenes |

| | |
|---|---|
| Enterobacter | agglomerans |
| Enterobacter | amnigenus |
| Enterobacter | cloacae |
| Enterococcus | avium |
| Enterococcus | durans |
| Enterococcus | faecalis |
| Enterococcus | faecium |
| Enterococcus | gallinarium |
| Enterococcus | raffinosus |
| Escherichia | coli |
| Eubacterium | aerofaciens |
| Eubacterium | lentum |
| Eubacterium | limosum |
| Flavobacterium | breve |
| Flavobacterium | meningosepticum |
| Flavobacterium | sp |
| Fusobacterium | sp |
| Fusobacterium | mortiferum |
| Fusobacterium | necrophorum |
| Fusobacterium | nucleatum |
| Fusobacterium | varium |
| Gardnerella | vaginalis |
| Gemella | haemolysans |
| Gemella | morbillorum |
| Gemella | sp |
| Haemophilus | aphrophilus |
| Haemophilus | influenzae |
| Haemophilus | parainfluenzae |
| Haemophilus | paraphrophilus |
| Hafnia | alvei |
| Kingella | sp |
| Klebsiella | ornithinolytica |
| Klebsiella | oxytoca |
| Klebsiella | ozaenae |
| Klebsiella | pneumoniae |
| Kluyvera | sp |
| Lactobacillus | acidophilus |
| Lactobacillus | catenaforme |
| Lactococcus | cremoris |
| Lactococcus | lactis |
| Legionella | pneumophila |
| Leptotrichia | buccalis |
| Leuconostoc | sp |
| Listeria | monocytogenes |
| Moraxella | catarrhalis |
| Moraxella | osloensis |
| Moraxella | phenylpyruvica |
| Moraxella | sp |
| Morganella | morganii |
| Mycobacterium | avium |
| Mycobacterium | genavense |
| Mycobacterium | tuberculosis |
| Mycobacterium | avium-intracellulare |
| Mycoplasma | sp |
| Myroides | odoratum |
| Neisseria | cinerea |
| Neisseria | flavescens |
| Neisseria | meningitidis |
| Neisseria | mucosa |
| Neisseria | sp |

| | |
|---|---|
| Neisseria | subflava |
| Nocardia | asteroides |
| Nocardia | sp |
| Ochrobactrum | anthropi |
| Pasteurella | multocida |
| Peptostreptococcus | anaerobius |
| Peptostreptococcus | asaccharolyticus |
| Peptostreptococcus | magnus |
| Peptostreptococcus | micros |
| Peptostreptococcus | prevotii |
| Prevotella | bivia |
| Prevotella | buccae |
| Prevotella | loescheii |
| Propionibacterium | acnes |
| Propionibacterium | granulosum |
| Proteus | mirabilis |
| Proteus | penneri |
| Proteus | vulgaris |
| Providencia | rettgeri |
| Providencia | sp |
| Providencia | stuartii |
| Pseudomonas | aeroginosa |
| Pseudomonas | alcaligenes |
| Pseudomonas | diminuta |
| Pseudomonas | fluorescens |
| Pseudomonas | paucimobilis |
| Pseudomonas | putida |
| Pseudomonas | sp |
| Pseudomonas | stutzeri |
| Pseudomonas | vesicularis |
| Salmonella | enteritidis |
| Salmonella | paratyphi |
| Salmonella | typhi |
| Salmonella | typhimurium |
| Serratia | fonticola |
| Serratia | marcescens |
| Serratia | odorifera |
| Serratia | sp |
| Shigella | dysenteria |
| Shigella | flexneri |
| Shigella | sonnei |
| Sphingomonas | paucimobilis |
| Staphylococcus | aureus |
| Staphylococcus | auricularis |
| Staphylococcus | capitis |
| Staphylococcus | caprae |
| Staphylococcus | chromogenes |
| Staphylococcus | cohnii |
| Staphylococcus | epidermidis |
| Staphylococcus | haemolyticus |
| Staphylococcus | hominis |
| Staphylococcus | intermedius |
| Staphylococcus | kloosii |
| Staphylococcus | lugdunensis |
| Staphylococcus | saccharolyticus |
| Staphylococcus | saprophyticus |
| Staphylococcus | sciuri |
| Staphylococcus | simulans |
| Staphylococcus | warneri |
| Staphylococcus | xylosus |

| | |
|---|---|
| Stenotrophomonas | maltophilia |
| Stomatococcus | mucilaginosus |
| Streptococcus | acidiminimus |
| Streptococcus | adjacens |
| Streptococcus | agalactiae |
| Streptococcus | anginosus |
| Streptococcus | bovis |
| Streptococcus | canis |
| Streptococcus | constellatus |
| Streptococcus | cremoris |
| Streptococcus | crista |
| Streptococcus | defectivus |
| Streptococcus | dysgalactiae |
| Streptococcus | equinus |
| Streptococcus | equisimilis |
| Streptococcus | intermedius |
| Streptococcus | lactis |
| Streptococcus | mitis |
| Streptococcus | mutans |
| Streptococcus | oralis |
| Streptococcus | pneumoniae |
| Streptococcus | pyogenes |
| Streptococcus | salivarius |
| Streptococcus | sanguis |
| Streptococcus | alpha-hemolyticus |
| Streptococcus | beta-hemolyticus |
| Veillonella | parvula |
| Veillonella | sp |
| Yersinia | enterocolitica |

46. An analytical method according to any of claims 42 – 45, wherein the immobilized specific recognition elements are selected from the group comprising, e.g., natural and synthetically fabricated polynucleotides, polynucleotides with artificial bases and / or artificial carbohydrates, peptides, peptide nucleic acids ("PNA"s), PNA's with artificial bases, LNAs, proteins (e.g. antibodies), ribozymes, and aptamers.

47. An analytical method according to any of claims 42 – 45, wherein the immobilized specific recognition elements are selected from the group of antibiotics-based recognition elements comprising, e.g., macrolide antibiotics (e.g. erythromycin, azithromycin, streptogramin), aminoglycoside antibiotics (e.g. neomycin, paromomycin, lividomycin, gentamycin), and peptide antibiotics (e.g. thiostreptone, micrococcin).

48. An analytical method according to any of claims 42 – 45, for the simultaneous determination of one or more different bacterial 16S-rRNA in a liquid sample, comprising providing an analytical chip comprising

- an evanescent field measurement platform, e.g. an optical waveguide, as a solid carrier and
- a plurality of polynucleotides immobilized in discrete measurement areas of known location forming an array of measurement areas on said evanescent field measurement platform,

wherein

- a multitude (i.e. 2 or more) of different polynucleotides is immobilized in discrete measurement areas for the detection of each different 16S-rRNA, the sequences of the immobilized polynucleotides being essentially complementary to different subsequences of the 16S-rRNA to be detected, which are not directly adjacent and not overlapping in the sequence of said 16S-rRNA,
- a liquid sample, not being subjected to an amplification (e.g. by polymerase chain reaction PCR or linear amplification "T7") of the polynucleotide sequences contained therein, is brought into contact with the array under conditions allowing a hybridization of 16S-rRNA contained in the sample with essentially complementary polynucleotides immobilized in the measurement areas
- changes of electro-optical signal caused by a successful hybridization on the measurement areas of the evanescent field measurement platform are measured with one or more detectors, and
- the presence of a bacterium to be detected is determined from the whole of signals from those measurement areas occupied by immobilized polynucleotides dedicated for the specific detection of said bacterium.

49. An analytical method according to claim 48, wherein the immobilized polynucleotides for the detection of the bacterial 16S-rRNA have a length of 5 – 500, preferably of 10 – 100 bases.

50. An analytical method according to any of claims 48 – 49, wherein the plurality of immobilized polynucleotides comprises 2 – 20 different polynucleotides which are essentially complementary to different subsequences of the same bacterial 16S-rRNA to be detected.

51. An analytical method according to claim 50, wherein the plurality of immobilized polynucleotides comprises less than 10, preferably less than 5 different polynucleotides which are essentially complementary to different subsequences of the same bacterial 16S-rRNA to be detected.

52. An analytical method according to any of claims 42 - 47, wherein the plurality of immobilized specific recognition elements comprises less than 10, preferably less than 5 different specific recognition elements which can bind specifically to different subsequences of the same bacterial 16S-rRNA to be detected.

53. An analytical method according to any of claims 48 – 51, wherein bacterial genus and / or species and / or strain can be determined with a plurality of less than 10, preferably of less than 5 different immobilized polynucleotides, that hybridize specifically with subsequences of the 16S-rRNA of said genus or species or strain.

54. An analytical method according to any of claims 42 – 53, wherein the bacterial 16S-rRNA to be detected is fragmented into strands of less than 500, preferably of less than 200 base pairs length.

55. An analytical method according to any of claims 42 - 54, wherein the evanescent field measurement platform comprises an optical waveguide

56. An analytical method according to any of claims 42 – 55, wherein the evanescent field measurement platform comprises an optical waveguide, which is continuous or partitioned into discrete waveguiding areas.

57. An analytical method according to claim 56, wherein the optical waveguide is an optical film waveguide with a first optically transparent layer (a) on a second optically transparent layer (b) with lower refractive index than layer (a).

58. An analytical method according to any of claims 42 – 57, wherein the detection of the presence of bacterial 16S-rRNA is based on the change of one or more luminescences, preferably of one or more fluorescences.

59. An analytical method according to claim 58, wherein the luminescence (fluorescence) used for analyte detection is generated by luminescence (fluorescence) labels, which are bound to or associated with the 16S-rRNA to be detected.

60. An analytical method according to claim 58, wherein said labels are bound to polynucleotides to be determined in a sample by a chemical (non-enzymatic) conjugation method.

61. An analytical method according to any of claims 59 – 60, wherein said labels have excitation and emission wavelengths between 250 nm and 1100 nm.

62. An analytical method according to any of claims 59 – 61, wherein said luminescence labels are selected from luminescent, functionalized or intercalating dyes and luminescent, functionalized nanoparticles ("quantum dots").

63. An analytical method according to any of claims 57 - 62, wherein in-coupling of excitation light into the optically transparent layer (a), to the measurement areas, is performed using one or more grating structures (c), that are formed in the optically transparent layer (a).

64. An analytical method according to any of claims 48 - 63, wherein a pattern of said changes of electro-optical signal caused by a successful hybridization of a multitude of immobilized polynucleotides, in different measurement areas, dedicated for the detection of one or more 16S-rRNA, ("sample hybridization pattern" of said 16S-rRNA) to be determined in a sample is established and recorded.

65. An analytical method according to claim 48 - 64, wherein a "reference hybridization pattern" is established and recorded by bringing a liquid sample containing a known amount of one or more different known 16S-rRNA into contact with said analytical chip under conditions allowing for hybridization between said known 16S-rRNA and the corresponding multitudes of complementary immobilized polynucleotides.

66. An analytical method according to claim 65, wherein reference hybridization patterns are stored in a data library.

67. An analytical method according to any of claims 65 - 66, wherein 16S-rRNA contained in a sample are determined by comparison of a sample hybridization pattern and one or more reference hybridization patterns, upon determining the degree of agreement between said sample hybridization pattern and said reference hybridization patterns.

68. An analytical method according to claim 67, wherein the degree of agreement between said sample hybridization pattern and said reference hybridization patterns is determined by statistical methods.

69. An analytical method according to claim 67, wherein the degree of agreement between said sample hybridization pattern and said reference hybridization patterns is determined by mathematical clustering methods.

70. An analytical method according to claim 67, wherein the degree of agreement between said sample hybridization pattern and said reference hybridization patterns is determined by artificial neural networks.

71. An analytical method according to any of claims 42 - 70, wherein a pattern of said changes of electro-optical signal caused by a successful binding of a multitude of immobilized specific recognition elements in different measurement areas, dedicated for the detection of one or more 16S-rRNA, ("sample binding pattern" of said 16S-rRNA) to be determined in a sample is established and recorded.

72. An analytical method according to claim 42 - 71, wherein a "reference binding pattern" is established and recorded by bringing a liquid sample containing a known amount of one or more different known 16S-rRNA into contact with said analytical chip under conditions allowing for binding between said known 16S-rRNA and the corresponding multitudes of complementary immobilized specific recognition elements.

73. An analytical method according to claim 72, wherein binding patterns are stored in a data library.

74. An analytical method according to any of claims 72 - 73, wherein 16S-rRNA contained in a sample are determined by comparison of a sample binding pattern and one or more reference binding patterns, upon determining the degree of agreement between said sample binding pattern and said reference binding patterns.

75. An analytical method according to claim 74, wherein the degree of agreement between said sample binding pattern and said reference binding patterns is determined by statistical methods.

76. An analytical method according to claim 74, wherein the degree of agreement between said sample binding pattern and said reference binding patterns is determined by mathematical clustering methods.

77. An analytical method according to claim 74, wherein the degree of agreement between said sample binding pattern and said reference binding patterns is determined by artificial neural networks.